

Use rooting hormones or not—multiple applications may be best[©]

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INTRODUCTION

Plant growers know when propagating plants from cuttings rooting hormones are essential to produce quality roots. The question may come up, if one rooting hormone application is good, are two or more applications better?

Rooting hormones can be applied by either basal or foliar methods. Basal methods use either dry power rooting hormones or rooting solutions. Foliar methods use aqueous K-IBA rooting solutions on leafy cuttings in the growing state. Traditionally these methods have been used by one application. However a secondary K-IBA rooting solution foliar applications may enhance the rooting of slow-to-root cuttings and may make crops that have differences in growth more uniform. The first rooting hormone application, at time of sticking, may be performed by any foliar or basal method. Secondary applications are performed by spraying on leaves by the Spray Drip Down Method[®]. Secondary applications are used on cuttings already in media; subsequent sprays do not disturb the cuttings. Secondary applications have been successful at 10 days to 2 weeks after the first application. Also successful are 3 day applications in sequence directly after sticking.

Many factors must be considered to develop single or multiple rooting hormone applications. For plants propagated from cuttings, the cuttings must be taken from carefully maintained stock plants. Rooting hormone applications improve root formation on unrooted (see the Ball FloraPlant[™] study below) and rooted cuttings. Juvenile cuttings root at lower rooting hormone rates as compared with mature cuttings (see the *Ficus* study). To select the optimal rooting hormone rates trials must be made at low to high rates (see the *Ficus* and *Osteospermum* studies).

The first rooting hormone application may be performed by any basal or foliar method. Secondary K-IBA Rooting Solution applications must be foliar by the Spray Drip Down Method[®] using an aqueous solution such as Hortus IBA Water Soluble Salts[®]. First and secondary foliar spray applications may be at the same rate (see rates, methods and products below). There are positives to using secondary applications with no apparent negatives. When using secondary applications, herbaceous plant cuttings may perform better and plants may benefit from foliar spray where root generation is stimulated.

FOUR STUDIES CITED

- “Use rooting hormone or eat ice cream?” by K. Carlsson and L. Munoz, Ball FloraPlant[™] (Carlsson and Munoz, 2016).
- *Osteospermum* study by A. Hammer (Hammer, 2017).
- Growth regulator effects on adventitious root formation in leaf bud cuttings of juvenile and mature *Ficus pumila* (Davies and Joiner, 1980).
- Decker Nursery study (Decker, 2016).

Ball FloraPlant[™] study

“Use Rooting Hormone or Eat Ice Cream?” (*Grower Talks*) by Ball FloraPlant[™] technical advisors, gave reasons for using rooting hormones. They note that some growers feel no need to use rooting hormones when propagating plants despite obtaining poor roots; they feel any roots are enough. However, poor cutting rooting results in poor plants and the application of rooting hormones to the cuttings result in high quality uniform roots. Ball FloraPlant[™] scientists used K-IBA rooting solutions made with Hortus IBA Water Soluble

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Salts®.

The Ball FloraPlant™ article states: “Is it worth it? Please trial under your propagation conditions to check.” “So, in conclusion, if you want to root cuttings as fast as Rickey Henderson steals bases, you should use rooting hormone. I think that you should start a trial today—even on crops that don’t require rooting hormone to see if you can root faster, high-quality liners. Our conclusion was that K-IBA spray at 100 ppm [for the crops studied] gave the best rooting results while providing the lowest input cost during sticking.”

***Osteospermum* study**

An *Osteospermum* study, by Dr. P. Allen Hammer, shows how optimum K-IBA rooting solution rates are selected and the effect of two solution applications. His *Osteospermum* herbaceous plant study was to find the optimum K-IBA rooting hormone rate and secondary spray timing. Trial K-IBA rooting solution rates were from low to very high. The study outline and results are shown below courtesy of Dr. Hammer.

Plant propagation from cuttings with single and multiple foliar K-IBA rooting solutions using *Osteospermum* cuttings.

1. Procedure.

- Cuttings were taken from *Osteospermum* “sweet yellow”.
- Cuttings were stuck.
- K-IBA rooting solutions were made with Hortus IBA Water Soluble Salts®.
- Cuttings were sprayed using the Spray Drip Down Method®.
- The K-IBA rooting solution was sprayed on leaves until drip down.
- The first and supplementary applications were at the same rate.

2. Treatment comparisons.

- Control cuttings had no treatment.
- One time treated cuttings had foliar solution application on day of sticking.
- Two times treated cuttings had foliar solution applications on day of sticking and the 10th day after sticking.

3. Results.

- The photos (Figures 1-3) taken on the 21st day after sticking
- Treated cuttings showed variable roots related to the K-IBA rooting solution rates. An optimum rate was established. Cuttings treated at rates lower and higher than that rate had reduced roots and root mass.
- Control: small roots and root mass.
- One time treated: variable roots and root mass at tested K-IBA rates.
- Two time treated: the best roots and root mass when treated two times at an optimum rate of 600 ppm K-IBA.



Control

Figure 1. Control (no treatment) rooting results with *Osteospermum* "sweet yellow".



200 ppm IBA One Treatment



400 ppm IBA One Treatment



600 ppm IBA One Treatment



1200 ppm IBA One Treatment

▲
Comparison Cutting

Figure 2. Rooting results (treat on the day of sticking) made with K-IBA rooting solutions made from Hortus IBA Water Soluble Salts®.

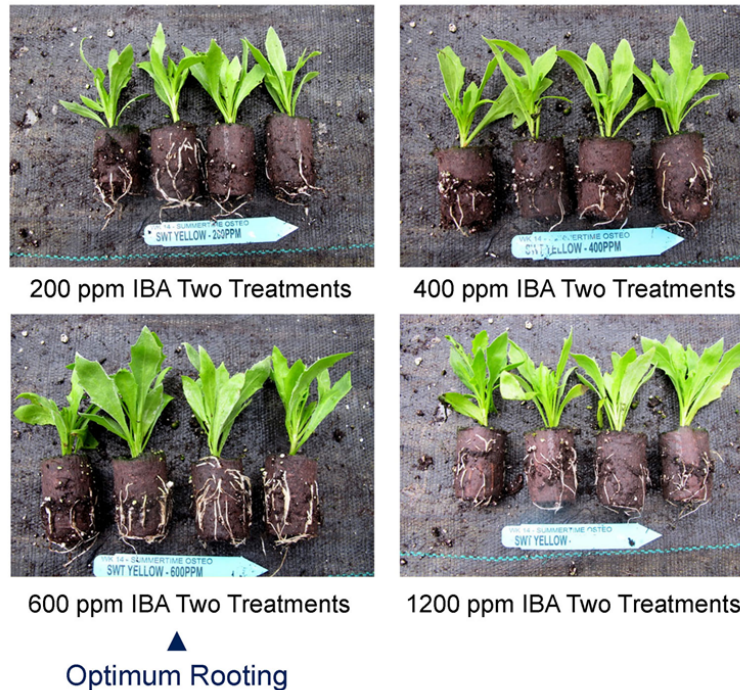


Figure 3. Rooting results (treat on the day of sticking) made with K-IBA rooting solutions made from Hortus IBA Water Soluble Salts®. Two times treated: first treat on the day of sticking and second treatment on the 10th day after sticking.

***Ficus pumila* study**

This study describes the efficacy of foliar applied aqueous K-IBA rooting solutions on root formation on juvenile and mature cuttings. It also discusses differences in root formation related to time-based applications. Dr. Davies' *F. pumila* study used either one foliar aqueous K-IBA rooting solution application at time of sticking and one application several days after sticking.

The study states: "Adventitious root formation was stimulated with foliar application of indolebutyric acid (IBA)." Dr. Davies' first step was to do "an experiment to establish optimum IBA concentration required for rooting." "All growth regulators were applied as aqueous sprays."

Juvenile vs. mature cuttings, "Lower IBA levels were required for optimal rooting in juvenile compared with mature LBC [leaf bud cuttings]." For the crop studied, they noticed rooting differences based upon type of cutting, "Hormonal effects during rooting stages: Percentage rooting in IBA pretreated cuttings was unaffected by additional IBA at any of the three time intervals after insertion, however, root length was reduced in all treatments. In juvenile LBC receiving no treatment, later IBA applications increased rooting in all dates, but in mature cuttings only the first or second application period was stimulatory."

Decker nursery study

"Foliar Applied Rooting Hormones" (International Plant Propagators' Society presentation), presented by Brian Decker. His study involved the propagation of woody cuttings and discusses the multiple foliar applications of rooting hormones. He used K-IBA rooting solutions made with Hortus IBA Water Soluble Salts®.

The study states: "Spray protocol for K-IBA spray application: Use a Hortus IBA water soluble salts solution." "Use a flag marker to mark each days sticking progress to track the 3-day spray rotation. All Hormone applications occur in early morning. Stomata are open and cuttings are generally not in moisture stress." "Improve root formation during positive trials

at either when spraying 3 days in a row after sticking, or spraying at three times weekly after sticking.”

The first and secondary applications were at the same rate. Decker also used an alternate method, applying soon after sticking with a secondary application after about 2 weeks. These techniques gave cuttings a stronger root mass compared with single treated cuttings. Extending Decker’s results, later weekly applications may improve the roots of slow-to-root cuttings.

DISCUSSION COMMENTS ON STUDIES

Rates, methods and products used in multiple rooting hormone applications

Two families of rooting products are used for plant propagation from cuttings.

- 1) For dry dip applications, dry dip rooting hormones consist of IBA in an insoluble talc base.
- 2) For foliar rooting solution applications, solutions are made using K-IBA dissolved in water. K-IBA is the water soluble form of IBA. If specified, K-IBA or IBA rates are the same.

1. Dry dip products, methods, and trial rates.

Products.

For the first rooting hormone application, one option is to treat by the dry dip method using an IBA rooting hormone powder. Some cuttings root best using dry dip powders. Typical rooting hormone powder products familiar to USA and European growers are: Rhizopon® AA #1 (0.1% IBA) which is used to root easy-to-root cuttings; Rhizopon® AA #2 (0.3% IBA), which is used to root easy to more difficult-to-root cuttings; and Rhizopon® AA #3 (0.8% IBA) which is used to root more difficult-to-root cuttings.

Method.

Dry dip method is only used for a first rooting hormone application: the basal ends of the cuttings are dipped about $\frac{3}{4}$ in. into the powder, then stuck in the medium.

Rates.

Trial rates using typical rooting hormone powders:

- Annual plant cuttings use dry dip powder Rhizopon AA #1, or Rhizopon AA #2.
- For perennial plant cuttings use Rhizopon AA #1, Rhizopon AA #2 or Rhizopon AA #3.
- For woody plant cuttings use Rhizopon AA #2, or Rhizopon AA #3.

2. Rooting solution products, methods, trial rates, and procedures.

When used for multiple applications, the first rooting solution application can be done by either the total immerse method or basal quick dip method. For the first and secondary K-IBA rooting solution applications the foliar Spray Drip Down Method® can be used. For secondary applications it is necessary to use the foliar Spray Drip Down Method®.

Products.

Rooting solution products: K-IBA is the water soluble form of IBA and the only labeled K-IBA rooting solutions for foliar methods are made with Hortus IBA Water Soluble Salts® and Rhizopon® AA Water Soluble Tablets.

Methods.

Rooting solution methods:

- Basal method:
 - o Basal quick dip method is only used for a first rooting solution application: the basal ends of the cuttings are dipped about $\frac{3}{4}$ in. into the rooting solution then

- stuck in the medium. Rates are established per plant type.
- Foliar methods:
 - o Spray Drip Down Method® is used for first or secondary rooting solution applications. The cuttings are stuck in medium. The rooting solution is sprayed onto the leaves until the solution drips down. Spraying is done soon after sticking or when not under heat stress, such as early morning. An excess of solution is best rather than a starved liquid volume. Facility appropriate spray equipment is used such as backpack, hydraulic, booms, or robots.
 - o Total immerse method is only used for a first rooting solution application: The cuttings are totally immersed a few seconds in the rooting solution then stuck in media.

Rates for foliar K-IBA rooting solution trials.

Rates for the Spray Drip Down Method® and Total Immerse Method® (for first time application) trialled IBA and rooting solution rates using Hortus IBA Water Soluble Salts®. The first foliar and supplementary applications are at the same rate. Where K-IBA or IBA rates are specified they should be considered the same.

- For annuals, perennials, chrysanthemums: 80-250 ppm IBA (typical 150-200 ppm).
- For herbaceous and hard-to-root perennial cuttings: 250-1500 ppm IBA (typical 750-1000 ppm).
- For woody ornamental cuttings: 300–1500 ppm IBA (typical 750-1000 ppm).

Procedures.

When starting cuttings trial, secondary applications for herbaceous and woody plant cuttings should be by first treating by any method, near or at the time of sticking. For secondary applications select either of these ways:

- First treat then should repeat with sprays at about 10 day to 2 week intervals.
- First treat then should spray the cuttings two additional days in a row.

When transplanting young rooted plantlets the objective should be to improve root generation and root mass

Rooted transplants, including grass divisions, may be treated both first and secondary by the foliar Spray Drip Down Method®. Repeat spray at about 2 week intervals. Foliar rooting solution rates are similar to those used for initial rooting.

Optimum cuttings and rooting hormones by single or multiple applications

The need for single or multiple rooting hormone applications is related to cutting quality. The best quality cuttings must be selected when propagating using rooting hormones.

Juvenile cuttings are preferred. It is first necessary to determine the optimal rate by performing a block of trials on un-rooted cuttings using low to high rates as seen in the *Osteospermum* study. When performing rate trials on herbaceous cuttings from off-shore plantations, it may be possible to determine standard optimal rates. Plantations maintain juvenile stock, discarding old plants. Rates may be specific to taxon but not necessarily suitable for the entire species. Cultivars not “needing” multiple sprays or higher dose of K-IBA Hortus IBA Water Soluble Salts® rooting solutions may not show problems, yet have positive results. Woody cuttings have an additional variable as seen in the *Ficus* study. Juvenile cuttings taken early in the season require lower rates than mature cuttings taken later in the season. Mature cuttings may not have as much reaction to application when applied later in the rooting cycle.

The strategy to perform multiple solution applications has merit. It needs to be tested on various plant taxa. If a specific species or cultivar has low rooting ability then multiple applications may be less likely to be effective, or may be timing dependent. The results might not be the same within a cultivar.

Secondary rooting hormone application may be beneficial if after one application is it

found cuttings are slow-to-root or have a low rooting percentage.

Trials must be made to compare a single application method with secondary applications. For secondary applications always use the foliar Spray Drip Down Method® using Hortus IBA Water Soluble Salts® rooting solutions. For all applications the Spray Drip Down Method® may be most effective and convenient. Growers who root many crops and cultivars at one time may find it is harder to spray different cultivars with a specific rooting solution rate that may be optimal for each cultivar. Spraying all cultivars with the rate that works for the most difficult cultivar is not detrimental for the better rooting cultivars, and easier for the grower.

To answer the question, if one rooting hormone application is good, are two or more applications better? It is worth trying!

Literature cited

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